

Embedding Sustainable Safety into Remedial Systems at Operational Facilities.

*RemTech 2016, Banff Springs Hotel and Conference Centre
October 12, 2016*

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Aggressive Remediation Approaches

- In Situ Approaches

- **In situ chemical oxidation (ISCO)**
- In situ chemical reduction (ISCR)
- Bioremediation
- **In situ thermal remediation (ISTR)**
 - Steam enhanced extraction
 - Electric resistance heating
 - In situ thermal desorption (conductive heating)
 - Radio frequency heating
 - In situ smoldering



Risks of ISTR Approaches

In Situ Thermal Remediation

- Assessment Phase
 - Drill rigs and drilling
 - Soil and groundwater sampling
 - Field analytical testing
- Construction and Operation
 - Hot surfaces and pressurized pipelines
 - Pressurized piping and hoses
 - Volatilized contaminant vapors
 - Electrical systems
 - Ground fault and electromagnetic radiation
 - Chemical handling and storage
 - Wet slippery surfaces



Hazards During Assessment at an ISTR Site



- Struck by something (vehicles, moving parts, release of energy)
 - Fork lifts, drill rig, support vehicles
 - Rotating components – Kelly bar, mud pumps
 - Hydraulic fitting failure
- Caught between / crushed by something
 - Pinch points
 - Cuts, puncture wounds from sharp edges
 - Lifting
- Injury from slippery surfaces, tripping hazards, and falls
 - Slips around drill rigs
 - Trips in well field (stepping over piping, exposed pipes)
- Environmental conditions (chemical exposure, fire/explosion, dust/particles, loud noises, heat stress)
- Human factors
 - Operator error

What is Sustainable Safety?





Human Factors





80%

OF INDUSTRIAL ACCIDENTS
**ARE ATTRIBUTABLE TO
ORGANIZATIONAL AND
HUMAN FAILURES**

Contributing factors to fatal incidents and high potential events:

Poor hazard
identification or
risk assessment

Inadequate
supervision

Unsuitable **working**
standards and
procedures

Improper
decision-making or
lack of judgment

Unintentional
violation (by
individual or group)

Insufficient /ineffective
training or
competency

Human /Operator Error: When the operator of the equipment is responsible for an unintended consequence.

- The operator or anyone on the assessment team:
 - makes a bad decision,
 - ignores directions,
 - becomes distracted. or
 - does something out of character while operating a machine or system and causes a mishap or accident.

This includes:

- Failing to perform a task
- Performing a task incorrectly
- Performing a non-required task
- Performing tasks out of sequence
- Failing to perform the task within a required time limit
- Failing to respond adequately to a contingency



Process Safety Management



Achieving performance in a complex system

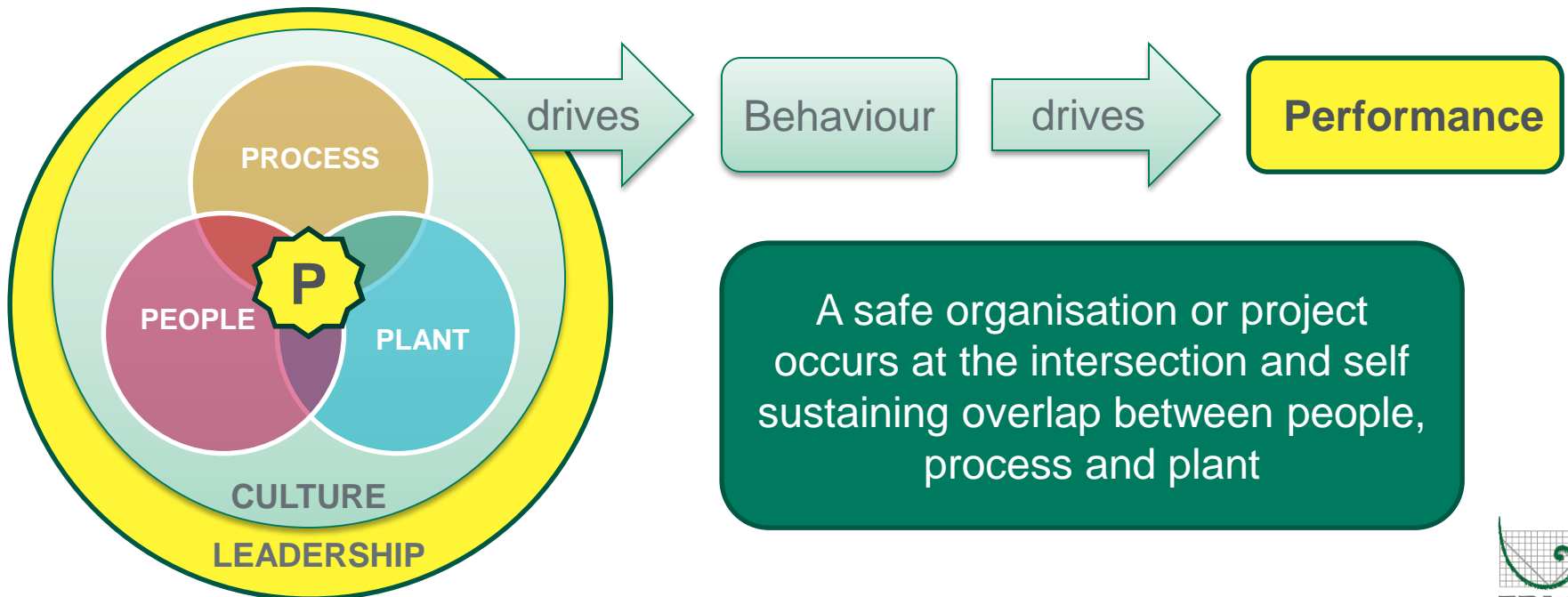


Any organisation or project is a techno-social system

Culture is an emergent property of these systems

Leadership directly influences the systems **AND** culture (via visible commitment and actions of leaders at all levels)

Behaviour and performance are driven by culture



Something with the potential for harm. In the context of people, assets or the environment, a hazard is typically any energy source that, if released in an unplanned way, can cause damage.

ICMM H&S CC Management – Good Practice Guide

There are two key things to remember about hazards:

- They are intrinsic to your operations/activities
- You have control over them

Recognizing Hazards

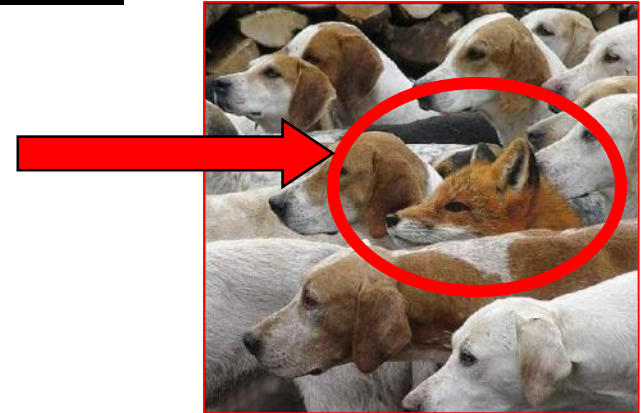
Why is it important to develop hazard recognition skills?

- You can't put warning signs/labels on everything



DIRECTIONS: Apply to wet hair. Gently work into lather. Rinse thoroughly with warm water. Repeat if desired. For best

- Hazards aren't always obvious
- To combat complacency
- **So you don't get hurt!**





Managing Work Safely



Drill rig safety



- Daily Safety Checks
- Know the type of drill rig and hazards
 - Hollow stem auger
 - Direct push (Geoprobe)
 - Sonic
 - Rotary – air or water
- Maintenance and Inspections
- Training and Competency of the drilling team
- Site set up – location of drilling rig in relation to people, plant and services
- Each location can have a new set of hazards. Recheck and if necessary convene a tailgate session.



Interior Drilling Hazards

- Vertical obstructions
- Overhead obstructions
- Trip hazards
- Sonic tube “swing”
- Overhead electrical and utilities
- Poor lighting
- Improper drilling material storage.





Managing Incidents



5 Rules to “Live” by...

1. When planning work and before setting up machinery on site always LOOK UP and check for overhead utility lines
2. Treat all overhead lines as energized and dangerous. Any contact may be fatal or cause serious injury
3. Lock out or turn off power when possible.
4. Maintain safe distance as electricity can arc or “jump” gaps.
5. Illuminate the work area in poor light conditions.





Fit To Work



In particular, the purpose of the Fit to Work Medical is to protect and preserve the health of employees engaged in travel and work in environments and/or client facilities that pose significantly different health risks than the employee's permanently assigned work environment.

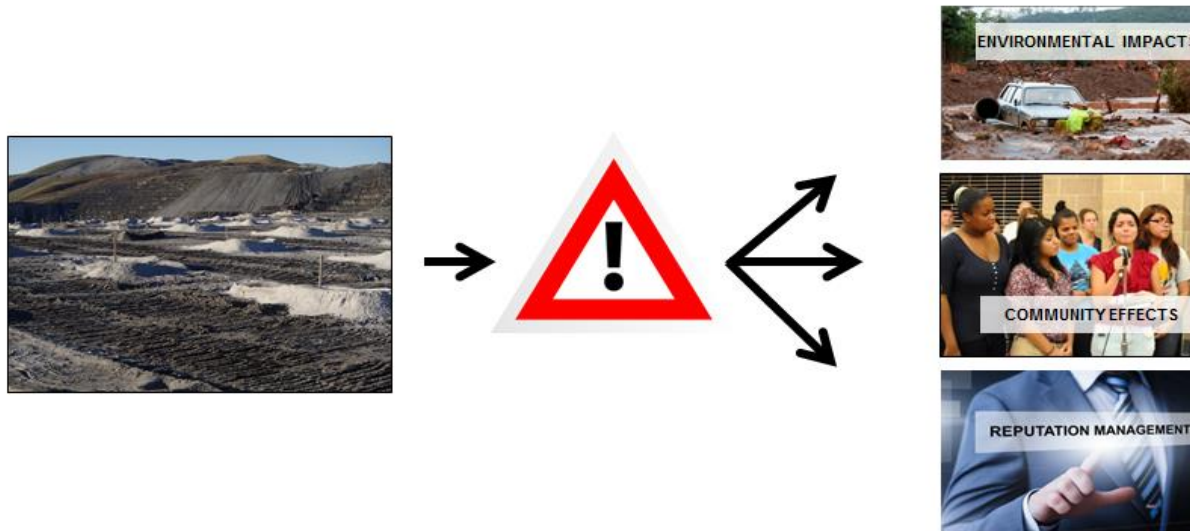
- Determine the requirement for any additional precautions e.g. Vaccinations
- Health Surveillance
- Noise
- Vibration

A certificate will be provided to deem the person either Fit for Work, Not Fit for Work or Fit for Work with Restrictions.

Leadership and Processes for Performance



- We want people to STOP WORK and have safety interventions BEFORE something becomes a danger
- Repeat issues – you may need to be more firm in your interventions.



All employees & Contractors have Stop or Pause Work Authority



*Irrespective of our contract arrangements we should **not hesitate** to use our Stop Work Authority in safety critical situations.*

In non-safety critical situations, the way we need to communicate this may be different depending on our contract arrangements and if we are supervising our own subcontractors or our client's subcontractors.

This is especially important when there is the potential for significant financial implications

Any Questions?

